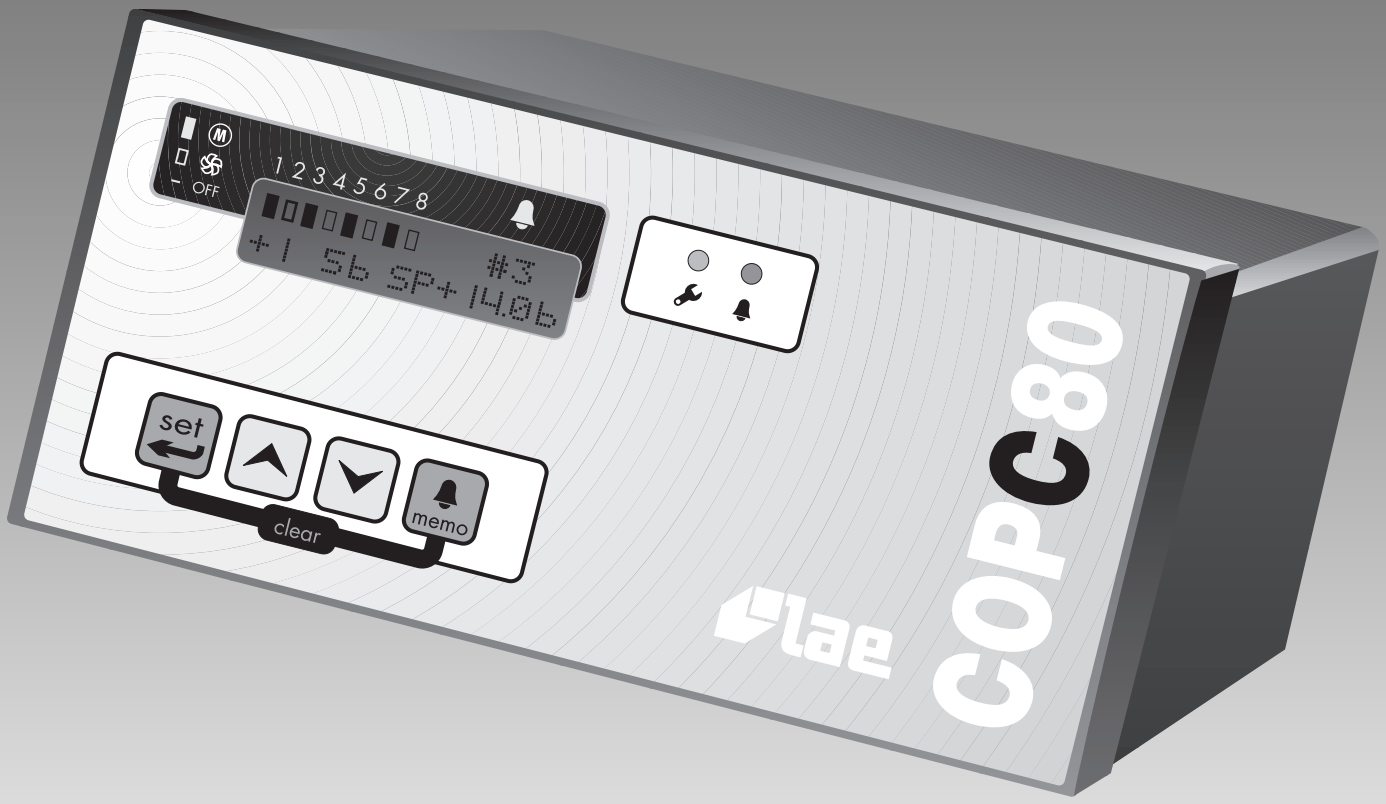
COPC 80

Instructions for installation and use



Before proceeding to the installation of the COPC 80, we recommend you to read this instruction booklet carefully and entirely. Only in this way you will obtain maximum performance and reliability.
The **COPC 80** controls the refrigerant gas pressure on condenser. Through sophisticated algorithms the COPC can control up to eight outputs to drive single or multiple speed fans and monitor the signals coming from auxiliary protection and control circuits on real time. The main unit is connected by means of ribbon cable to one or two COPM 28 modules in which are the outputs and their diagnostics.

1 INSTALLATION

1.1 Secure the COPC 80 main unit through its snap-on system to a 0.7...1.5mm thickness panel, with 182x81 mm cutout. Carefully check that there is no gap between the rubber gasket and the panel.

1.2 Secure the COPM 28 control modules to the DIN-rail, as close as possible to the main unit.

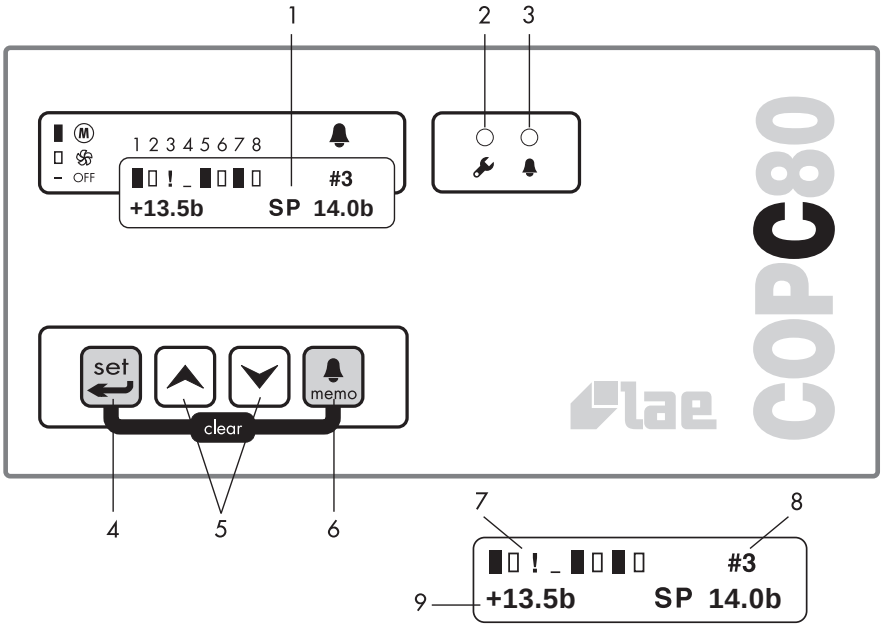


FIGURE 1

1 Backlit LCD display
2 Periodic maintenance LED
3 Current alarm LED
4 Programming access key
5 Increase/decrease keys
6 Key to display stored alarms
7 Output status indicator
8 Alarm status/counter indicator
9 Operating data

1.3 For a correct function, the system must operate at an ambient temperature between -10°...+50°C and 15%.. 80% relative humidity.
To reduce the effects of electro-magnetic disturbances, locate the signal cables (probe, ribbon cables etc.) and the controller as away as possible from contactors and power wires. Do not wrap the excess of cable but "Z" fold it.

1.4 Probe, power supplies and all inputs/outputs of the system must be connected strictly following the indications appearing on this technical sheet (see fig. 2 and 3).

CAUTION: The wiring panel of the COPC 80 is under voltage. Beware of **electrical shocks**, an accidental contact may be fatal to persons or animals.

2 INDICATIONS

The LCD [1] allows to clearly display all possible indications helping to understand number and configuration of the fans, their present status and the accumulated run time, pressure or temperature of the gas in the condenser, possible current or stored alarms.
To facilitate understanding even more, it's possible to select the language (English, German, Spanish, Italian).

2.1 On power-up, the entire display [1] is on for 2 seconds approx., after that the software release appears and finally all display areas take their specific functions.

2.2 In area [7] of the display the enabled outputs, from 1 to 8, and their status appear: ***stand-by***, control output off status for an undefined time; (-) switched off output; (▮) switched on fan motor; (▯) rotation speed step; (!) output on alarm from diagnostics input.

2.3 If alarms are on, on area [8] their source appears: ***probe***, pressure transmitter fault or overrange; ***out'N'***, no feedback from output 'N'; ***psw.HP***, HIGH Pressure switch external contact; ***aux.***, auxiliary alarm contact opening.
Area [8], if no alarms are on, shows the number of stored alarms: none, 1,..10.

2.4 In area [9], through keys [5] it's possible to select the data to display: condensing GAUGE pressure and setpoint; corresponding temperature and setpoint; totalized run time of the fan motors.

2.5 By pressing and keeping key [6] pressed, the stored alarms are displayed in area [9]; it's possible to scroll this memory backwards and forwards by means of keys [6]+[5] or cancel the displayed location with keys [6]+[4].

2.6 LED [2] illuminates when at least one of the fan motors achieves the programmed run hours for the warning to come up.

2.7 LED [3] blinks when an internal or external alarm is detected.

3 PROGRAMMING

The COPC 80 is a controller able to perform complex control functions to the best, it must therefore be able to recognize the plant connected to it without any doubt. To this purpose, before the first system start-up, it is mandatory to program the configuration parameters carefully in order to obtain a perfect adaptation of the COPC control algorithms to the specific plant.
As such parameters have a different influence on the whole function, access to the various settings has been divided into 4 levels. This partition aims to allow access to authorised service technicians only, avoiding in this way dangerous configuration mistakes.
The partition of the parameters, their identification code and the programmable range appear on Table A.
CAUTION: beware that reprogramming some of the parameters implies a total re-configuration of the COPC operating mode, we therefore recommend to put the controller on stand-by in the event that you have to change parameter values of level higher than 1.

3.1 You have got access to programming by keeping key [4] pressed for 2 sec. Now, the display asks for the pass code; set your own code by means of keys [4]+[5]. If the code is 0 or invalid, you have access to level #0 parameters only.

3.2 Through keys [5], achieve the desired parameter, press then [4]+[5] to set the value. All parameters except the pass code are stored in non-volatile memory and resumed on following power-ups.
Exit from programming occurs automatically after 15 sec. of no operation on the keyboard or immediately, by simultaneously pressing both keys [5].

3.3 Parameter function:

1. **pass code**, allows access to the various programming levels.
2. **stand-by**, enables (NO) or switches off (YES) the control and alarm functions.
3. (language), allows to display all inscriptions in the favourite language.
4. **LCD contrast**, suitably adjusts the contrast on display according to viewing angle, ambient light etc.
5. **main SET**, provides the reference condensing pressure, becoming the dead zone mid value.
6. **alternative SET**, if enabled and switched on, replaces the main SET temporarily.
7. **dead zone**, adds a pressure gap, above and below the current set, such as to maintain the output status unchanged as long as pressure remains within this band.
8. **fan cut-in delay**, the condensing pressure must be higher than the upper dead zone for this time before the next fan motor cuts in.
9. **fan stop delay**, the condensing pressure must be lower than the lower dead zone for this time before the next fan motor stops.
10. **minimum fan stop**, provides the minimum time that must elapse between fan motor stop and its next cut-in.
11. **maximum fan run**, if greater than 0, establishes the time lapse after which considering the possibility of swapping two fan motors.
12. **speed increase delay**, provides the minimum time in which the condensing pressure must be higher than the upper dead zone before the next rotation speed increase.
13. **speed decrease delay**, provides the minimum time in which the condensing pressure must be lower than the lower dead zone before the next rotation speed decrease.
14. **peripheral number**, gives the COPC an address in the event that, through the serial port, the controller must be linked to a data transmission network.
15. **number of fans**, provides the number of outputs that are connected to fan motors. The maximum programmable value depends on parameter 16.
16. **number of speeds/fan motor**, provides the number of speed steps for each fan (equal for all). The maximum programmable value depends on parameter 15.
17. **ordinary sequence**, if enabled (YES), equally shares starts and run times among ALL fan

motors. Differently (NO) the fan connected to output 1 will be excluded from this sequence. It will be always the first to start and the last to stop.

18. **refrigerant**, allows Pressure⇨Temperature conversion according to the refrigerant media used.
19. **probe offset**, adds a constant correction to the value measured by the pressure transmitter to obtain the value to be processed by the COPC (display, control etc.).
20. **minimum probe current input**, programmed according to the 0...20/4...20 mA transmitter used.
21. **minimum range**, this value must match the minimum transmitter range, i.e. the pressure corresponding to its minimum current (0/4mA).
22. **maximum range**, this value must match the maximum transmitter range, i.e. the pressure corresponding to a 20mA current.
23. **alternative SET input**, if enabled (YES), when providing the required on voltage to the relevant input, it shifts the control reference value, i.e. the dead zone mid value will be parameter 6 instead of 5.

24. ... 31. **output 1 ... 8 diagnostics**, if enabled (YES), carries out a monitoring on the corresponding output to detect an interruption by external causes. Differently (NO) the voltage applied to the feedback inputs will have no effect on the controller operation.

32. **condenser High Pressure switch input**, if enabled (YES), checks that the relevant input always receives the required on voltage. If this condition is not fulfilled, the COPC considers this as a high pressure alarm on the condenser side. If disabled (NO), this input is not considered.
33. **auxiliary alarm input**, if enabled (YES), checks that the relevant input always receives the required on voltage. If this condition is not fulfilled, the COPC signals this as an auxiliary alarm. If disabled (NO), this input is not considered.
34. **next maintenance**, provides the amount of run hours of at least one fan motor for the maintenance warning to come up (LED [2]).

35. ... 42. **output 1 ... 8 run time**, allows to reset the hour counter for each output so as to permit the programming of a new maintenance cycle.

43. **0 adjust**, allows low range recalibration.
44. **full scale adjust**, allows span recalibration.

4 OPERATION

On every power-up, after self-check (4 sec approx.), the COPC starts to control according to the latest programmed values.

4.1 STAND-BY. With par.**2**=YES the control functions are suspended, the COPC proceeds to progressively switching off all the outputs with fixed 5 sec steps and on area [7] of the display "stand-by" appears.
This status remains even on following power-ups until the control is enabled again (par.**2**=NO).

4.2 PRESSURE CONTROL. During the normal control phases, the COPC acts on the outputs to constantly maintain the condensing pressure around the reference value. Such value is given by par.**5** or, if par.**23**=YES and the set selection input receives the required on voltage, by par.**6**.
If the measured pressure stays within the reference value ± the dead zone (par.**7**), the number of switched on outputs will not change. If pressure exceeds par.**5/6** + par.**7**, the on sequence starts, differently, if the pressure drops lower than par.**5/6** - par.**7**, the off sequence starts.

4.3 CUT-IN DELAYS. When a condensing pressure increase requires that an output is switched on, before the switching takes place the COPC waits that this condition constantly remains for a time at least equal to: par.**8** if, according to the control sequence, the next output is a fan motor, par.**12** if a rotation speed step.

4.4 STOP DELAYS. Before switching off an output because of a condensing pressure drop, the COPC waits that this condition constantly persists for a time at least equal to: par.**9** if, according to the control sequence, the next output is a fan motor, par.**13** if a rotation speed step.

4.5 CONTROL SEQUENCE. With par.**17**=YES, the fan to be switched on(off) is identified according to its last run(stop) time lapse, in other words the fan motors are sorted by length, from the longest to the shortest. Example, in this situation: MV1=ON for 5 min.; MV2=OFF for 7 min., MV3=OFF for 8 min., MV4=ON for 6 min.; the sequence will be ON⇨MV3, MV2; OFF⇨MV4,MV1.
With par.**17**=NO, the fan motor connected to output 1 will always be the first to start and the last to stop whereas the remaining fans alternate with each other according to the control logic described above. This sequence is chosen when you want to differentiate the operation of the fan motor located at the hot gas inlet.
In both cases, a fan motor will only be switched on when all running fan motors are at the maximum speed already.

4.6 CUT-IN LIMITATION. To avoid mechanical stress to the fan motors reducing their life, it's possible to limit the starts per hour by setting par.**10** greater than 0. In this case, as long as this rest time has not elapsed, a fan is excluded from the control sequence. If this happens, on

the basis of the selection mode (see 4.5), the COPC gets started the first fan fulfilling this criterion.

4.7 FORCED ROTATION. During the normal operation pressure swings out of the dead zone, therefore the control algorithm induces an automatic swap of the running fans and, as a final result, a total run time equalization.
If, on the contrary, the pressure remains within the dead zone for a long period, no output variation will take place. A remedy is to enable forced rotation.
By giving par.**11** a value greater than 0, when a running fan motor achieves the time lapse programmed (ex. 30 min.) and a stopped fan motor fulfilling the swapping criteria (shorter total run time, minimum stop etc.), then it forces rotation process. The controller switches off the fan to get the designated one running.

4.8 OUTPUT OPTIMIZATION. If as a result of an alarm, two fan motors are simultaneously reduced in speed (speed rotation less than 100%), the COPC starts the optimization function. It proceeds to a progressive power shift from a fan to the other, according to the programmed control algorithm.
This optimizes the electrical power consumption without changing the mechanical power.

4.9 FAST POWER INCREASE. If a HIGH PRESSURE alarm takes place, the outputs will progressively be switched on in 5 second steps, until reaching full power.

5 ANOMALIES AND ALARMS

The COPC 80 features a sophisticated abnormal operation condition detection system. When an anomaly is detected, area [8] of the display shows its source (see 2.3) and, as long as the condition persists, the alarm relay contacts will change status and LED [3] blinks. The buzzer goes off simultaneously with the other signallings but pressing any of the keys can mute it.
Every alarm event is stored in non-volatile memory, it will not therefore be lost with a power failure. For this function 10 records are available and when they are filled the following alarms will be lost. Therefore we recommend to periodically erase the old alarms from the memory as described in 2.5.
On stand-by all alarms are suspended.
In the next paragraphs is a description of the alarm sources, the corresponding indications on area [8] of the display and the possible repercussions on the control logic.

5.1 TRANSMITTER FAULT/OVERRANGE, *"probe"*. Signalled if the pressure transmitter exceeds the range programmed with par.**21** (with 4...20mA exclusively) or par.**22**.

5.2 HIGH PRESSURE ON CONDENSER SIDE, *"psw.HP"*. Signalled when par.**32**=YES and the relevant input does not receive the required on voltage. This alarm causes output **fast increase** (see 4.9). The alarm ends when the input receives the required on voltage again.
With par.**32**=NO this alarm is inhibited.

5.3 AUXILIARY ALARM, *"aux."*. This alarm is available for installers' general purposes. It signals when one or more external alarm events occur, provided that par.**33**=YES and the relevant input does not receive the required on voltage. The alarm ends when the input receives the required on voltage again.
With par.**33**=NO, this alarm is inhibited.

5.4 OUTPUT FAULT, *"out 'N'"*. Usually every large or middle sized fan motor has got a series of protecting devices aiming at preserving itself from damage arising from winding overheating, or other anomalies. By linking all these contacts together, a safety chain is created that opens whenever a critical condition occurs.
The output monitoring has the purpose of detecting contactor coil supply interruption as a result of protection intervention (see figure 3).
The monitoring is enabled by giving YES to the relevant flag (par.**24**...**31**). If the diagnostics is enabled and its feedback input does not receive the required on voltage, the COPC detects the anomaly and reacts by signalling the alarm condition (*out'N''* and (!) on display; LED [3]; relay etc.) and excluding the fan motor from the control sequence waiting for a self-recovery.
Whenever the NC contacts on the COPM 28 are used, you must consider an inverted feedback signalling.

5.5 POWER SUPPLY FAILURE. In this case an alarm signalling occurs through the relay contacts only, no other shining or acoustic signallings take place and this anomaly is not stored in the alarm memory.

6 AUXILIARY FUNCTIONS

In addition to what we described above, the COPC performs other functions with the purpose of facilitating the work of those who have to use it.

6.1 LANGUAGE. In any moment it's possible to change the language on the display by selecting it with par.**3** among those available.

6.2 DISPLAY CONTRAST. Through par.**4** it's possible to change the LCD display contrast. It allows to adjust indication readability to the best according to the operator's viewing angle

or ambient light.

6.3 PRESSURE⇨TEMPERATURE CONVERSION. Parameter **18** allows to select the refrigerant media used in order to correctly convert the setpoint and gauge pressure measured in its equivalent boiling temperature.

6.4 PROBE OFFSET. If the value read by the pressure transmitter does not match the pressure applied to it perfectly, it's possible to proceed to recalibration (see 7.) or add a constant correction value across the whole measuring range through par.**19**.

6.5 MAINTENANCE. If wishing to obtain an automatic periodical maintenance warning, it's possible to act on par.**34**...**42**. For example, if it's necessary to intervene after 5,000 fan motor run hours, set par.**34**=5,000. When any of the fans achieves 5,000 run hours, LED [2] lights up.
Now, after having performed the intervention required, you may enter PROGRAMMING at level #3 and clear the hour counters (par.**35**...**42**) to repeat the cycle or shift par.**34** to the next warning (ex. par.34=10,000).
Warning: the counters have a maximum capacity of 32,000 hours and are used to accumulate the run hours and for the FORCED ROTATION. It's therefore necessary to clear them before the overflow.

7 RECALIBRATION

Should it be necessary to recalibrate the COPC 80, then act in the following way: enter PROGRAMMING at level #3; put par.**19** to zero; check that par.**20**,**21**,**22** are correct. By means of an accurate current source, suitably connected to the controller input, give the current programmed in par.**20** (0 or 4mA).
Point par.**43**, operate keys [4]+[5] until the display indication matches the correct value (par.**21**).
Now increase the current to 20mA and point par.**44**, always by means of keys [4]+[5] match the displayed pressure with the one programmed in par.**22**.
After recalibration, exit from programming.

8 SERIAL COMMUNICATION

The COPC 80 is fitted with RS485 serial port allowing to take part in a data communication network managed by a master PC. The database puts all measurement and control data on the net. Through par.**14** you program the controller identification number.
For a detailed data organization description and communication protocol details, read the specific documentation.

TECHNICAL DATA

Dimensions	192x96x60 mm
Operating temp.	-10°C ...+50°C
Range	-1.0 ...+50.0 bar
Resolution	0.1 bar
Pressure input	0/4 ... 20 mA
Transmitter supply	8 ... 16Vdc
Auxiliary inputs	110-240Vac; 5 mA
Alarm relay output	SPDT; 5 A 240Vac
Supply voltage	230 Vac, ±10%; 50/60Hz
Consumption	4VA
Protection on front	IP 54

WARRANTY

LAE electronic Srl warrant that their products are free of any defects in workmanship and materials for a period of 1 (one) year from date of production shown on the enclosure. LAE electronic Srl shall first test allegedly faulty units and repair or replace those products with faults due to LAE electronic Srl. LAE electronic Srl are not liable for damages resulting from malfunctions of the products.
Defects due to exceptional operating conditions, misapplication and/or tampering will void the warranty.
All transport charges for returning the product to LAE, after their prior authorisation, and for the return to the purchaser must always be paid by the purchaser.

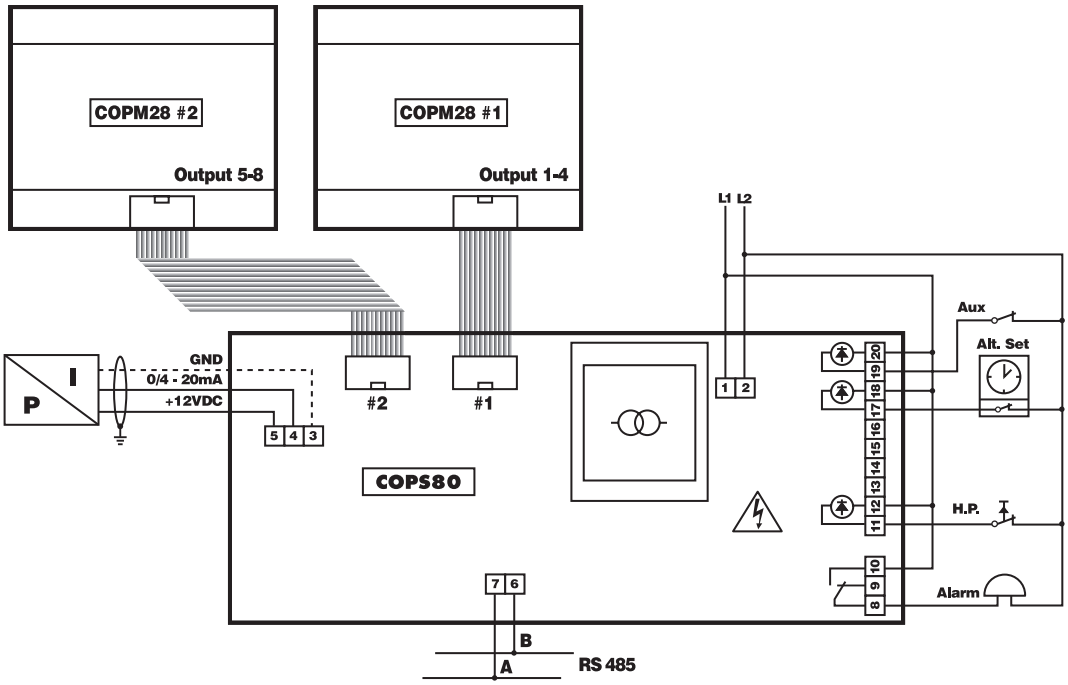


FIGURE 2

1-2 Power supply 230 Vac, 50/60 Hz
(3)-4 Pressure transmitter input
5 Transmitter supply +8...+16 Vdc, 25 mA
6-7 RS 485 serial communication port
8-9-10 Alarm relay 240 Vac, 5 A
11-12 High Pressure switch 110-240 Vac, 50/60 Hz
17-18 Alternative Set 110-240 Vac, 50/60 Hz
19-20 Auxiliary Alarm 110-240 Vac, 50/60 Hz

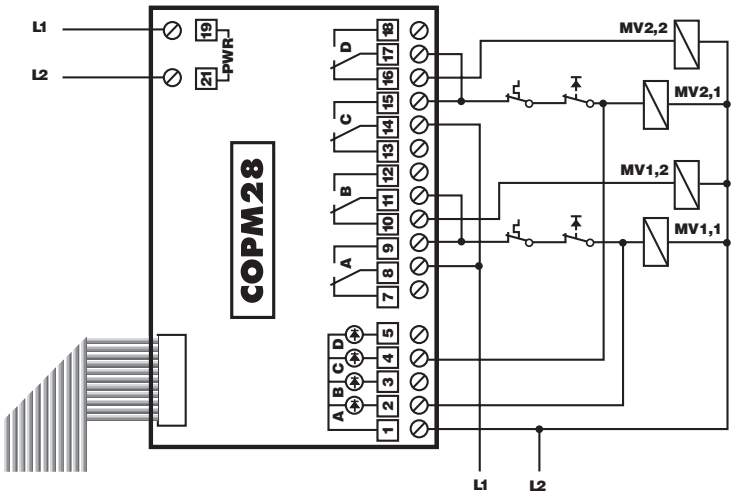


FIGURE 3

MV1,1 fan motor 1 contactor coil
MV1,2 MV1 2nd speed contactor coil
MV2,1 fan motor 2 contactor coil
MV2,2 MV2 2nd speed contactor coil

TABLE A				
Par.N	**Identification**	**Minimum and Maximum Limits**	**Factory Setting**	**Current Value**
1	**pass code**	0 ... 255	0	____
2	**stand-by**	YES / NO	YES	____
3	**(language)**	Italiano... Español	English	
4	**LCD contrast**	00 ... 100	50	
LEVEL #1, accessible with pass code 31				
5	**main SET**	min.range ... ... max.range	+10.0 b	
6	**alternative SET**	min.range ... ... max.range	+9.5 b	
7	**dead zone**	0.0 ... 5.0 bar	1.0 b	
8	**fan cut-in dly**	0 ... 60 seconds	5 sec	
9	**fan stop dly**	0 ... 60 seconds	10 sec	
10	**min. fan stop**	0 ... 20 minutes	2 min	
11	**max.fan run**	0 ... 120 minutes	60 min	
12	**speed incr. dly**	0 ... 60 seconds	3 sec	
13	**speed decr. dly**	0 ... 60 seconds	3 sec	
14	**peripheral ADDR**	1 ... 255	1	
LEVEL #2, accessible with pass code 69				
15	**No. fans**	1 ... 8(?)	4	
16	**No. speed/fan**	1 ... 8(?)	1	
17	**ordin. sequence**	YES / NO	YES	
18	**refrigerant**	R22, R134A, R404A-507	R134A	
19	**probe offset**	-2.0 ... +2.0 bar	0.0 bar	
20	**min.probe input**	0 ... 5 mA	4 mA	
21	**min.range**	-1.0 ... +5.0 bar	0.0 b	
22	**max.range**	+5.0 ... +50.0 bar	+30.0 b	
23	**altern.SET input**	YES / NO	NO	
24	**out 1 diagn.**	YES / NO	NO	
25	**out 2 diagn.**	YES / NO	NO	
26	**out 3 diagn.**	YES / NO	NO	
27	**out 4 diagn.**	YES / NO	N	
LEVEL #2, (continues)				
28	**out 5 diagn.**	YES / NO	NO	
29	**out 6 diagn.**	YES / NO	NO	
30	**out 7 diagn.**	YES / NO	NO	
31	**out 8 diagn.**	YES / NO	NO	
32	**HP press.input**	YES / NO	NO	
33	**auxil. input**	YES / NO	NO	
LEVEL #3, accessible with pass code 104				
34	**next mainten.**	500 ... 30'000 hours	1000 hrs	
35	**out 1 run time**	0 ... 50 hours	0	
36	**out 2 run time**	0 ... 50 hours	0	
37	**out 3 run time**	0 ... 50 hours	0	
38	**out 4 run time**	0 ... 50 hours	0	
39	**out 5 run time**	0 ... 50 hours	0	
40	**out 6 run time**	0 ... 50 hours	0	
41	**out 7 run time**	0 ... 50 hours	0	
42	**out 8 run time**	0 ... 50 hours	0	

43	**0 adjust**	Current pressure	—	
44	**full scale adj.**	Current pressure	—	

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